

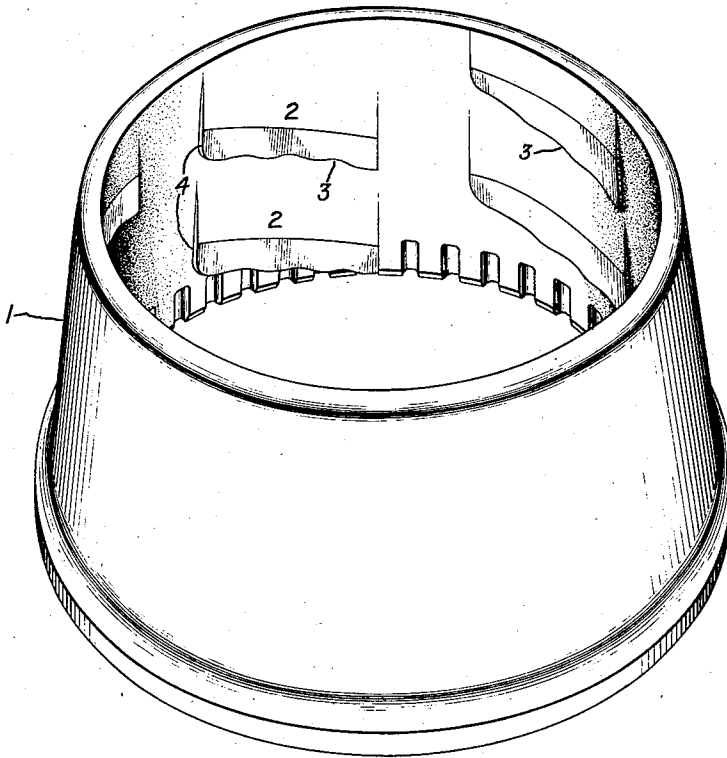
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CASE HARDENED MALLEABLE CASTING AND PROCESS FOR MAKING THE SAME

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CASE HARDENED MALLEABLE CASTING AND
PROCESS FOR MAKING THE SAMEJames H. Powers, Fort Wayne, Ind., assignor to
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6 Claims. (Cl. 148—21.55)

The present invention is a case hardened malleable iron casting and a process for heat treating malleable iron castings whereby the surfaces of such castings are hardened and toughened to such an extent that they are suitable for use as shredding elements in electrically operated garbage disposal units. Hitherto these units generally have employed sintered hard metal compositions of the character disclosed in Schroter Reissue Patent No. 17,624 as the shredding medium. While cemented carbides are satisfactory for that purpose they are far more expensive than surface hardened malleable iron.

It is one of the objects of my invention to provide a surface hardened malleable iron casting having a hard, deep case. A further object is the provision of a surface hardened malleable casting which may be manufactured economically and which is suitable for use as a shredding element in a garbage disposal unit.

The novel features which are characteristic of my invention are set forth with particularity in the appended claims. My invention however will best be understood from reference to the following specification when considered in connection with the accompanying drawing in which the single figure is a perspective view of the shredding element of a garbage disposal unit embodying the features of the present invention.

The unit comprises a casting 1 provided on its inner surface with circumferentially spaced integral projecting portions 2 each of which gradually increases in thickness towards its lower edge. The lower edge 3 and side portion 4 of each projection serve to effect the shredding operation in a manner well known in the art and disclosed in my copending application Serial No. 393,227, filed May 13, 1941, which became Patent No. 2,322,058 on June 15, 1943.

In order to make a malleable casting suitable for use as a shredding element it is necessary to increase its tensile strength, wear resistance and hardness. These results as well as improvements in impact resistance and corrosion resistance are secured by the addition of a small quantity of alloying ingredients and by a heat treatment which develops maximum physical properties in the alloy.

In carrying out the present invention a casting is employed which, before malleabilization, con-

tains the following ingredients in approximately the percentages indicated:

	Per cent
Carbon -----	2.30 to 2.50
5 Silicon -----	.90 to 1.10
Manganese -----	.70 to .90
Molybdenum -----	.50 to 1.10
Copper -----	.40 to .60
Chromium -----	.20 to .30
10 Phosphorus -----	.18 maximum
Sulphur -----	.12 maximum

The malleabilizing operation reduces the carbon content of the alloy to about .80 to 1.10%. The free carbon content of the alloy is more greatly reduced in a thin section than in a thick section during the malleabilizing process and in castings about $\frac{1}{8}$ of an inch thick the carbon content is reduced to about .80 to .90%. After being malleabilized the casting is heated to a temperature of about 1600° F. for a period of time which may vary from about 45 minutes to about 1 hour and 15 minutes, or long enough to effect a condition of solution in the surface portion of the casting. The heating preferably is carried out in a liquid bath furnace which prevents decarburizing of the casting during the high temperature heat treatment. A suitable liquid bath furnace of this type is known in the trade as the "Holden" furnace. The casting is quenched, preferably in oil, from the temperature of 1600° F. to a temperature of about 650° F. While the casting might be quenched to room temperature it has been found that if the casting is quenched only to a temperature of about 650° F. it is harder and tougher than if quenched to room temperature. If the casting is quenched in oil to room temperature a hardness of about 52 to 56 is obtained on the Rockwell C scale. On the other hand, if the casting is quenched from about 1600° F. to about 650° F. the resulting hardness is about 62 to 71 or more on the Rockwell C scale. Ordinarily, it would be expected that warpage and cracking would be relieved by an arrested quench but on the same basis it would be expected that the hardness would be reduced and not increased as indicated above. After quenching to 650° F. the casting is drawn or tempered in a furnace heated to a temperature of about 400° F. and kept in the furnace

for about two hours after which it may be cooled in air to room temperature.

The casting employed as the shredding element in a garbage disposal unit is about $\frac{3}{32}$ of an inch thick. After the above heat treatment the casting has a uniform, fine grained, hard, martensitic outer structure of deep penetration, for example about .040 to .050 inches and a central core which consists of relatively large globules of uncombined graphite or temper carbon characteristic of malleable iron. There is no sharp line of demarcation between the core and the outer hard case but rather a gradual fading out of the very dense case structure from the surface to the core of the casting.

The castings may be machined easily and cost relatively little in comparison with steel castings or castings employing hard carbide shredding inserts or elements. The depth of the case and the high degree of hardness obtained by my improved process are believed to be quite unusual. For example, in high grade heat treated steels, it is difficult to obtain a case depth of .03 inch and a hardness about 55 Rockwell C even when such steels are alloyed with a relatively high percentage of tungsten.

Manganese in the percentage indicated improves the hardness and toughness of the casting. Molybdenum improves its tensile and impact strength as well as its hardness and wear resistance. Copper increases the density and tensile strength of the casting and also improves its wear and corrosion resistance. The chromium may be omitted if desired but when present in the small percentage indicated provides somewhat improved resistance to wear. While I may employ a molybdenum content in the alloy which varies from about .50 to 1.10%, I prefer to employ a percentage of molybdenum varying from about .90 to 1.10%.

A particular advantage of the casting produced by my process is that it may be poured to provide relatively thin sections, for example a section of about $\frac{1}{8}$ of an inch thick which is hard and strong. The same casting if made of steel would require a wall thickness of about $\frac{3}{8}$ of an inch instead of about $\frac{1}{8}$ of an inch.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. A casting containing about .80 to 1.10% carbon, about .90 to 1.10% silicon, about .70 to .90% manganese, about .50 to 1.10% molybdenum,

about .40 to .60% copper with the remainder substantially all iron, said casting having a case at least .04 inch thick and a hardness of 62 to 71 or more on the Rockwell C scale.

2. A casting containing about .80 to .90% carbon, about .90 to 1.10% silicon, about .70 to .90% manganese, about .90 to 1.10% molybdenum, about .40 to .60% copper with the remainder substantially all iron, said casting having a case about .04 to .05 inch thick and a hardness of about 62 to 71 or more on the Rockwell C scale.

3. A casting containing about .80 to .90% carbon, about .90 to 1.10% silicon, about .70 to .90% manganese, about .90 to 1.10% molybdenum, about .40 to .60% copper, about .20 to .30% chromium with the remainder substantially all iron, said casting having a case at least .04 inch thick and a hardness of about 62 to 71 or more on the Rockwell C scale.

4. The method of hardening the surface of a malleable iron casting containing about .80 to 1.10% carbon, about .90 to 1.10% silicon, about .70 to .90% manganese, about .50 to 1.10% molybdenum, about .40 to .60% copper with the remainder substantially all iron which comprises heating the casting at a temperature of about 1600° F., quenching the casting to a temperature of about 650° F. and then drawing the casting at a temperature of about 400° F.

5. The method of hardening the surface of a malleable iron casting containing about .80 to 1.10% carbon, about .90 to 1.10% silicon, about .70 to .90% manganese, about .50 to 1.10% molybdenum, about .40 to .60% copper with the remainder substantially all iron, which comprises heating the casting at about 1600° F. for about 45 to 75 minutes, quenching the casting to about 650° F., and thereafter drawing the casting at about 400° F. for about two hours.

6. A shredding element for a garbage disposal unit, said element comprising a casting containing about .80 to 1.10% carbon, about .90 to 1.10% silicon, about 0.7 to 0.9 manganese, about .50 to 1.10% molybdenum, about .40 to .60% copper with the remainder substantially all iron, said casting having a case provided with projecting integral means for effecting the shredding operation, said case having a thickness of at least .04" and a hardness of 62 to 71% or more on the Rockwell C scale.

JAMES H. POWERS.

CERTIFICATE OF CORRECTION.

Patent No. 2,354,055.

July 18, 1944.

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It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, first column, line 24, for the word "about" read --above--; and second column, line 43, for "0.9" read --0.9%--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 26th day of September, A. D. 1944.

Leslie Frazer

(Seal)

Acting Commissioner of Patents.